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SAMPling Plan

9/9/86
This version has incorporated EPA's Comments.

PROJECT FOR PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES AT UNCONTROLLED HAZARDOUS SUBSTANCE FACILITIES—ZONE 1

NUS CORPORATION
SUPERFUND DIVISION

000001

ORIGINAL
(Red)

R-585-6-6-37
[redacted] INTERIM REPORT OF
MATTHEWS ELECTROPLATING
PREPARED UNDER

TDD NO. F3-8602-45
EPA NO. VA-106
CONTRACT NO. 68-01-6699

FOR THE

HAZARDOUS SITE CONTROL DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

SEPTEMBER 9, 1986

NUS CORPORATION
SUPERFUND DIVISION

SUBMITTED BY	REVIEWED BY	APPROVED BY
GILBERT MARSHALL GEOLOGIST	RICHARD CROMER ASSISTANT MANAGER	GARTH GLENN MANAGER, FIT III

Site Name: Matthews Electroplatin
TDD No.: F3-8602-45

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Site Name: Matthews Electroplatin
TDD No.: F3-8602-45

ORIGINAL (Red)

APPENDICES

ORIGINAL
(Red)

SECTION I

000005

Site Name: Matthews Electroplatin
TDD No.: F3-8602-45

1.0 INTRODUCTION

1.1 Authorization

NUS Corporation performed this work under Environmental Protection Agency Contract No. 68-01-6699. This specific report was prepared in accordance with Technical Directive Document No. F3-8602-45 for the Matthews Electroplating site located 3.5 miles southwest of Salem, Virginia.

1.2 Scope of Work

NUS FIT III was tasked to provide site response support for the Matthews Electroplating site. The specific elements of the TDD are described in appendix A of this report.

1.3 Background

The Matthews Electroplating site is located on a 1.7-acre property along Virginia Secondary Route 796, near the intersection of Virginia State Route 460 and Interstate Route 81 in Roanoke County, approximately 3.5 miles southwest of Salem, Virginia (see appendix B, figure 1). The site operated as an auto bumper repair and electroplating facility from 1972 until 1976. Liquid electroplating waste had been discharged from the facility directly onto the ground. The waste reportedly traveled 50 feet over the ground and drained into a sinkhole beneath the southwestern portion of the property.

In November 1975, in response to residents' complaints about their well water, the Virginia State Water Control Board (VA SWCB) began monitoring approximately 30 residential wells within the site area for contamination with chromium, nickel, cyanide, and other pollutants. Some of these wells were found to have chromium levels above the EPA safe drinking water limit of 0.05 mg/l (50 ug/l) of total chromium.

ORIGINAL

In January 1976, VA SWCB ordered the site owner, Mr. J.T. Matthews, to (Red) and desist from further discharge of wastewater from the plating operation. In that same January, the owner installed equipment for treating and evaporating liquid waste. In June 1976, Matthews declared bankruptcy, and the First Federal Savings and Loan Association of Roanoke Valley held the foreclosed mortgage for the site. The bank sold the property to the current owner, Mr. Al Salem, who used the site for pig farming. As part of the purchase agreement, VA SWCB required the new owner to implement corrective measures to prevent further leaching of chromium into the groundwater system. The new owners performed some surface cleanup and placed a clay cap (minimum thickness of two feet) over the southwestern portion of the site.

From 1982 to 1983, EPA contracted Roy F. Weston, Incorporated (Weston) to conduct a remedial investigation and feasibility study (RI/FS) at the Matthews site. VA SWCB and Weston sampling data identified chromium contamination of groundwater in local residential wells. It is postulated that plating waste spills or discharges onto the ground migrated overland toward, and leached into, a sinkhole located in the southwestern portion of the site, which acted as a direct conduit to groundwater. An extensive soil sampling investigation performed by Weston identified two large areas of contaminated soils on site. An estimated 2,400 cubic yards of hexavalent chromium-contaminated soil exist in these 2 areas. Chromium concentrations in residential wells has continually decreased since the beginning of groundwater sampling in 1975 and 1976 (see appendix B, figures 5 and 6). However, the continued leaching of contaminated soils on site serves as a long-term source of hexavalent chromium to local groundwater. As such, it was decided that remedial measures were needed to provide an alternate source of potable water supplies to affected residences.

The alternative chosen for remedial action was the construction of a water main extension from the Salem Water Treatment Plant (approximately 2 miles northeast of the site) to the approximately 30 affected residents in the site area (see appendix B, figure 2). The City of Salem Water and Sewer Department operates and maintains the municipal water treatment plant. The Roanoke County Utility Department is responsible for operating and maintaining the water main extension from the treatment plant to the residents served by the new municipal water distribution system.

The design of this system was completed in 1984, and construction began in early 1985. Construction was completed and inspected in 1986. All of the 30 affected residents have abandoned their wells and have been tied into the municipal water supply system.

In March 1986, NUS FIT III was tasked by EPA to prepare a post-remedial sampling plan for the Matthews Electroplating site.

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SECTION 2

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Site Name: Matthews Electroplatin
TDD No.: F3-8602-45

2.0 HYDROGEOLOGIC SETTING

The Matthews Electroplating facility lies in the Valley and Ridge Physiographic Province of Roanoke County, Virginia. Tectonic forces originating from the southeast have intensely folded and thrust faulted the rocks of the Valley and Ridge. Massive amounts of older rocks have been thrust northwestward over younger rocks in this region. The Salem, Max Meadows, and Poor Mountain Faults delineate the imbricate thrust sheets occurring in the subject study area (see appendix B, figures 3 and 4).

Differential erosion of the rocks occurring in this area has formed alternating ridges, which are underlain by resistant clastic rocks and valleys, which are underlain by soluble carbonate rocks.

Specifically, the site is located approximately 0.4 mile northwest of the Max Meadows Fault and is underlain by the Cambrian Elbrook Formation. The Elbrook consists primarily of thin- to medium-bedded dolomite, with some limestone and shale. The attitude of this formation parallels the imbricate structure of this area, dipping approximately 25 degrees to the southeast. According to data collected during Weston's RI, locally the Elbrook dips between 25 to 30 degrees to the south and steepens to nearly vertical near the Big Hill Church. The Elbrook is reported to reach an approximate thickness of 1,000 feet beneath the site area.

Thrust faulting in this region has created extensive fracture zones which, through the solution action of groundwater (particularly in the carbonate rocks), have been further enlarged, improving conditions for groundwater occurrence and movement. It is reported that contaminants attributed to the subject site entered the groundwater via an on-site sinkhole. Results from previous investigations of this site indicate that an east-west trending subsurface fracture influences the local groundwater system. Groundwater movement and contaminant migration parallel this east-west linear pathway in the study area.

According to groundwater elevations and contamination trends, the predominant groundwater flow direction in the site area is from east to west. However, chromium contamination detected in the Lockhart well during more recent sampling investigations (January 27, 1982), as opposed to no detection during early investigations, indicates that a component of the groundwater flow regime beneath the site migrates toward the east. It is possible that this groundwater flow anomaly is in response to the cessation of pumping from abandoned residential wells west of the site and the continued pumping of the Broadview Subdivision wells, located approximately 2,000 feet east of the site area.

NUS had expected to compile a potentiometric surface contour map from pertinent well measurements taken during the field investigation of this site. This map would define the groundwater system beneath the site area and help determine the points to be used in the proposed groundwater sampling plan. However, because no wells were readily accessible (i.e., abandoned and buried), no measurements could be taken during the field investigation.

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SECTION 3

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3.0 FIELD INVESTIGATION

NUS FIT III was tasked by EPA to provide site response for the Matthews Electroplating site. A field investigation of the subject site was performed by NUS during the week of April 14, 1986. The objectives of this investigation were to review state and county file information for the Matthews Electroplating site; describe the present-day conditions of the site; conduct an in-depth well survey of the site area; and delineate the "as-built" extent of the remedial municipal water supply main extension. The purpose of this investigation is to develop a sampling plan to characterize the current groundwater conditions in the study area.

Only the main plating building remains standing on the Matthews Electroplating site. This building is currently used to store two automobiles, tools, and numerous boxes containing various paper products (paper towels, toilet tissue, etc.). The bumper preparation building and the building located in the extreme northern portion of the property have been demolished, and their rubble has been removed. Material from a borrow pit on site was used to grade the area surrounding the demolition activity. Neither the Matthews' "new" or "old" wells could be located during the site reconnaissance (see appendix B, figure 7, and the photograph log).

The municipal water supply main extension has been completed in accordance with EPA's Record of Decision (ROD) for the Matthews Electroplating site, dated June 2, 1983. The construction of this public water supply system was completed in February 1986.

The 30 residences now receiving water from the above-mentioned public water supply system have abandoned their wells. Most of these abandoned wells are buried and not accessible for well measurements or groundwater sampling. Many residents, however, expressed an interest in utilizing their wells in the future for agricultural (primarily irrigation) and cleaning purposes.

The 11 residences in the Viewpoint Heights subdivision have also been tied into the public water supply system, and their community well, located approximately 500 feet southeast of the site, has been abandoned.

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SECTION 4

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4.0 RECOMMENDATIONS

Previous investigations of the Matthews Electroplating site, conducted by VA SWCB and EPA from 1975 through 1984, have shown that chromium contamination of the groundwater has continuously declined since operations at the subject site ceased in 1977 (see appendix B, figures 5 and 6; and appendix D). Samples taken from local residential wells were used to characterize groundwater contamination in the study area. In general, the extent of contamination was controlled by a subsurface fracture and/or solution channel in the bedrock aquifer. The current concern at the subject site is to determine if any chromium is continuing to leach from contaminated soils on site into the ground and if the area affected by, and/or the concentrations of, contaminants are continuing to decrease. As such, sampling of the available residential wells should accurately characterize the remaining contamination and its extent. It should be noted that the proposed Recommended Maximum Contaminant Level (RMCL) for total chromium is 120 ug/l.[9]

According to the results of Weston's and VA SWCB's previous sampling investigations (1975 to 1982), only the Graybeal and Big Hill Church wells exceeded the RMCL.

Site Name: Matthews Electroplatir
TDD No.: F3-8602-45

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The following wells have been selected for the proposed groundwater sampling plan (see appendix B, figure 8, for well locations):

I. Residential wells in which total chromium levels have been detected above the current 50 ~~mg/l~~ ug/l public drinking water quality standard in previous sample analyses (1975 to 1984 by VA SWCB and Roy F. Weston, Incorporated) should be sampled in accordance with WPSI-1, Rev. 1, sections 8.4.3, 8.4.3.1, and 8.4.3.2. Sample analysis will be performed for inorganic tasks 1 and 2, and 3 for cyanide. Special Analytical Services (SAS) will also be requested to analyze these samples for hexavalent chromium (Cr^{+6}) and total chromium. Note: These samples must be analyzed by SAS within 48 hours of sampling.

- o Fore Well
- o Graybeal Well
- o Big Hill Church Well
- o Willis Well
- o Barnett Well

II. Residential wells in which total chromium levels have been detected above background detection limits (10 ug/l), but below the current drinking water quality standard (50 ug/l) will be sampled in accordance with WPSI-1, Rev. 1, sections 8.4.3, 8.4.3.1, and 8.4.3.2. Sample analysis will be performed for inorganic tasks 1 and 2.

- o Maxwell Well
- o Goff Well
- o Phillippi Well
- o Jackson Well
- o Statzer, Sr. Well
- o Hodge Well
- o Claxton Well

ORIGINAL (Red)

III. The Broadview Subdivision wells (2), which serve a community of 44 homes approximately 0.28 mile northeast of the site, should be sampled. These wells are of concern because the wells are believed to be located along (upgradient of the site) the same subsurface fracture that controls groundwater contaminant migration within the site area; it is suspected that, because the residential wells proximal to the site have been abandoned as part of the remedial action, the Broadview Subdivision wells may be influencing groundwater movement (i.e., upgradient) within the site area (as evidenced by the contamination of the Fore well); and these wells represent the only potentially endangered wells within the site area currently used for drinking water supplies. These wells will be sampled in accordance with WPSI-1, Rev. 1, sections 8.4.3 and 8.4.3.1. Sample analysis will be performed for inorganic tasks 1 and 2.

While sampling these wells, pertinent well and water-level measurements will be taken. From these data, a potentiometric surface contour map will be generated to characterize the groundwater system beneath the site area.

A total of 21 aqueous samples (if SAS requires separate samples for hexavalent chromium analysis), including blanks and duplicates, will be taken. Sample analysis will be performed as follows:

o Inorganic tasks 1 and 2, and 3 for cyanide		5 samples
o Inorganic tasks 1 and 2		9 samples
o Hexavalent chromium (SAS)		5 samples
o Blank aqueous		2 samples
	Total =	21 samples

Some of the residential wells cited above will be used in the near future for agricultural and cleaning purposes and will, therefore, be readily accessible for sampling. Access to other residential wells, particularly the buried, abandoned wells, will require the services of a local contractor to excavate overburden and possibly remove submersible pumps from these wells to obtain samples.

It will be necessary to maintain close contact with the individual well owners, VA SWCB, and EPA in order to perform a complete and cost-effective investigation of the subject site.

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SECTION 5

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5.0 REFERENCES

1. Breeding, N.K. Jr., and J.W. Dawson, Virginia State Water Control Board, Bureau of Water Control Management (West-Central Regional Office). Roanoke County Groundwater - Present Conditions and Prospects. Planning Bulletin 301, July 1976.

2. Waller, James O., Geohydrology of the Upper Roanoke River Basin, Virginia. Planning Bulletin 302, August 1976.

3. Roy F. Weston, Incorporated. Field Investigation Report for Matthews Electroplating Site, Salem, Virginia. October 1982.

4. Roy F. Weston, Incorporated. Feasibility Study Report for Matthews Electroplating Site, Salem, Virginia. January 1983.

5. Roy F. Weston, Incorporated. Report on Supplemental Field Investigations for Matthews Electroplating Site, Salem, Virginia. January 1983.

6. Roy F. Weston, Incorporated. Groundwater Use Risk Assessment for Matthews Electroplating Project Superfund Site. April 1983.

7. United States Environmental Protection Agency. Matthews Electroplating file information. (Obtained through Walter Graham, Site Response Section, EPA.)

8. NUS Corporation, FIT III. Field investigation of Matthews Electroplating site; field logbook and file information.

9. Federal Register. Proposed Rules. Volume 50, No. 219. November 13, 1985.

ORIGINAL (Red)

APPENDIX A

1. COST CENTER:	REM/FIT ZONE CONTRACT TECHNICAL DIRECTIVE DOCUMENT (TDD)	2. NO.:
ACCOUNT NO.:		F3-8602-45

3. PRIORITY:	4. ESTIMATE OF TECHNICAL HOURS:	5. EPA SITE ID:	6. COMPLETION DATE:	7. REFERENCE INFO.:
[x] HIGH [ ] MEDIUM [ ] LOW	300 4A. ESTIMATE OF SUBCONTRACT COST:	VA-106 5A. EPA SITE NAME: Matthews Electric Roanoke, VA	To be determined	[x] YES [ ] NO [ ] ATTACHED [x] PICK UP

8. GENERAL TASK DESCRIPTION: Provide site response support for the subject site.

9. SPECIFIC ELEMENTS:	10. INTERIM DEADLINES:
1. ~~Meet~~ with Walt Graham to define scope of project & determine requirements.	
2.) Review site geology/hydrology	
3.) Make recommendations for groundwater sampling to characterize the remaining contamination & plu	
4.) Estimate contaminant migration.	
5.) Prepare & submit interim report summarizing findings w/recommendations	4/18/86.
6.) Obtain groundwater & soil samples as necessary.	
7.) Install monitoring wells as necessary.	
8.) Prepare & submit final report.	

11. DESIRED REPORT FORM: FORMAL REPORT [x] LETTER REPORT [ ] FORMAL BRIEFING [ ]

OTHER (SPECIFY): Coordinate all activities with Walt Graham. Refer to the attached request for additional information.

12. COMMENTS: State code 051 County Code 770

13. AUTHORIZING RPO: Harold G Byer (SIGNATURE)	14. DATE: 4/10/86
15. RECEIVED BY: [x] ACCEPTED [ ] ACCEPTED WITH EXCEPTIONS [ ] REJECTED [signature] (CONTRACTOR RPM SIGNATURE)	16. DATE 4/11/86

Sheet 1 White – FITL Copy Sheet 3 Pink – Contracting Officer's Copy (Washington, D. C.)
Sheet 2 Canary – DPO Copy Sheet 4 Goldenrod – Project Officer's Copy (Washington, D. C.)

ORIGINAL
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APPENDIX B

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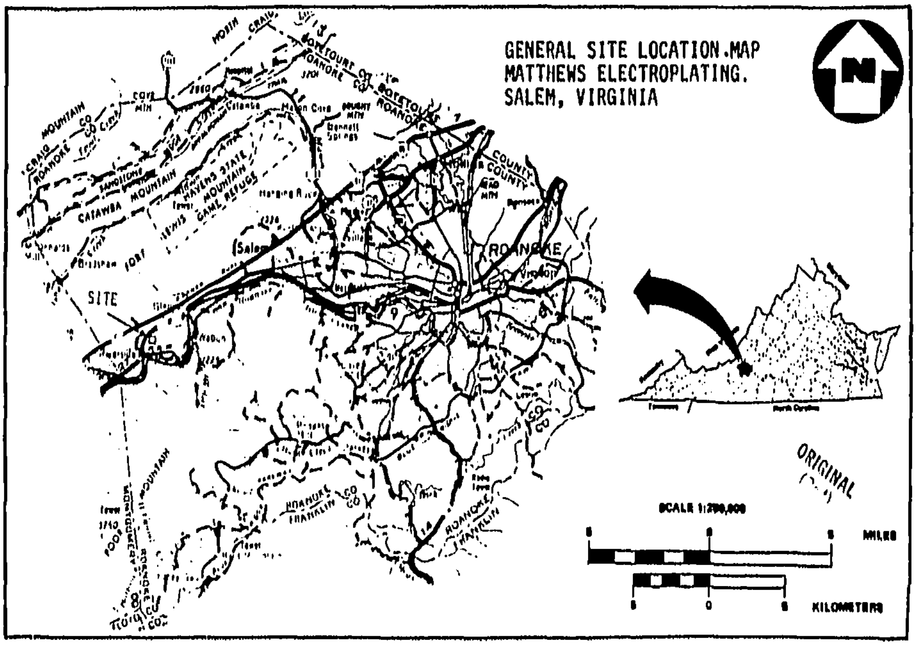
Possible

image



SOURCE: VIRGINIA STATE WATER CONTROL BOARD: WEST-CENTRAL REGIONAL OFFICE, ROANOKE COUNTY GROUNDWATER--PRESENT CONDITIONS AND PROSPECTS. BY N.K. BREEDING,JR. AND J.W. DAWSON JULY, 1976

FIGURE 1

NUS CORPORATION

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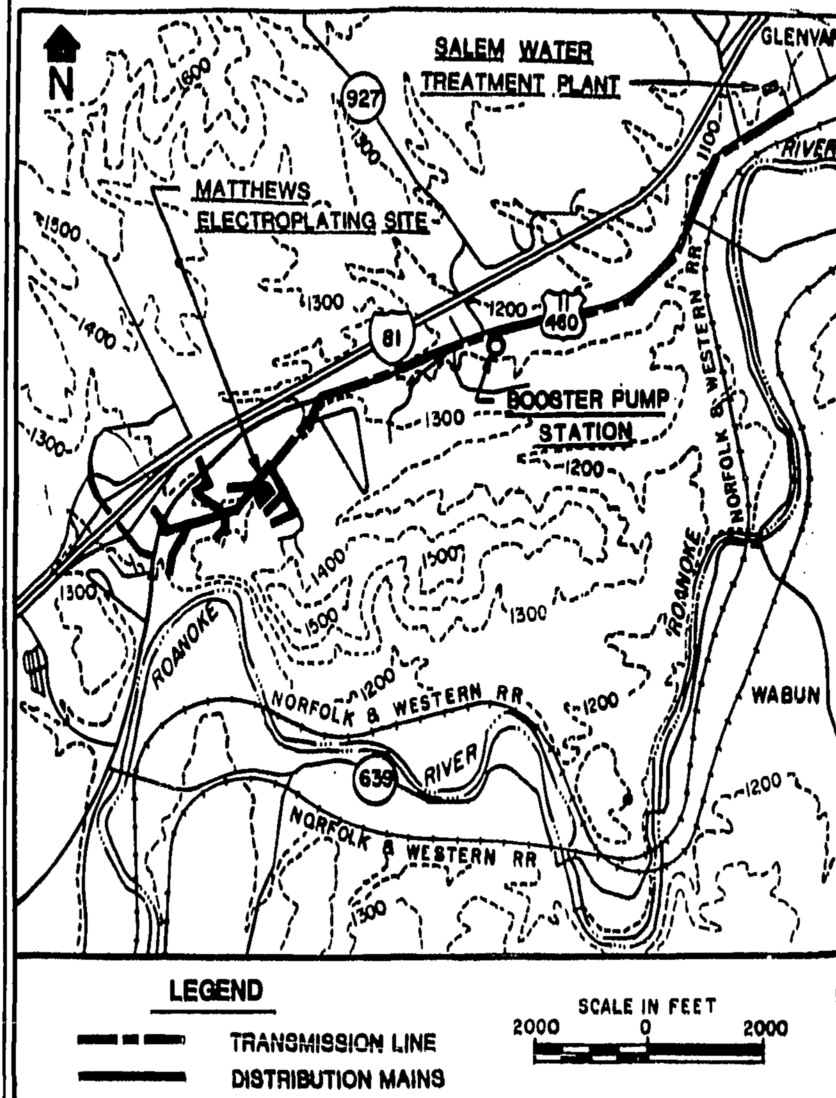
REMEDIAL MUNICIPAL WATER SUPPLY MAIN EXTENSION AS PER EPA'S RECORD OF DECISION

ORIGINAL (Red)



SOURCE: ROY F. WESTON, INC., FEASIBILITY STUDY REPORT FOR THE MATTHEWS ELECTROPLATING SITE, SALEM, VIRGINIA. JANUARY 1983

FIGURE 2

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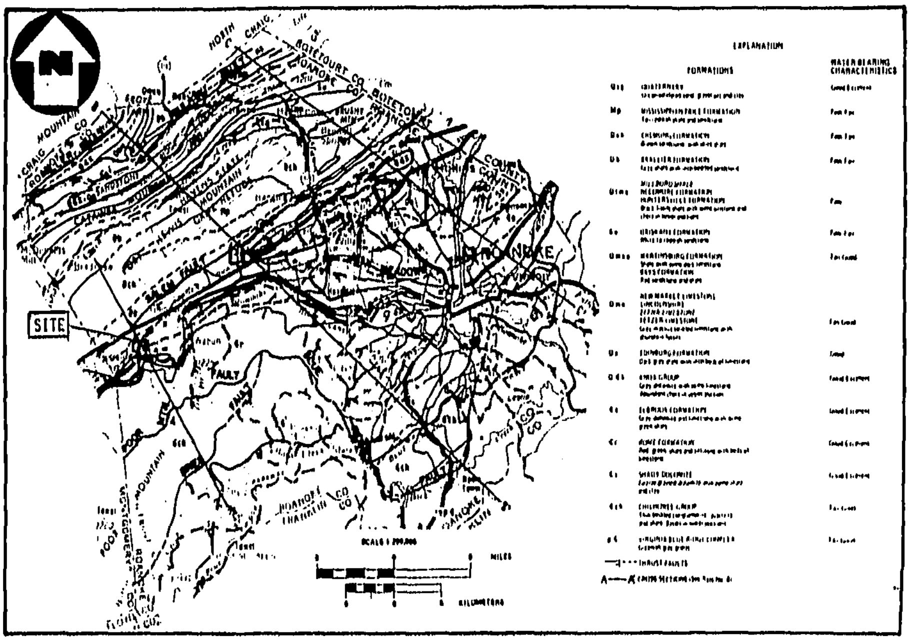
HYDROGEOLOGY OF ROANOKE COUNTY,VIRGINIA



SOURCE: VIRGINIA STATE WATER CONTROL BOARD: WEST-CENTRAL REGIONAL OFFICE,
ROANOKE COUNTY GROUNDWATER--PRESENT CONDITIONS AND PROSPECTS.
BY N.K. BREEDING,JR. AND J.W. DAWSON JULY, 1976

FIGURE 3

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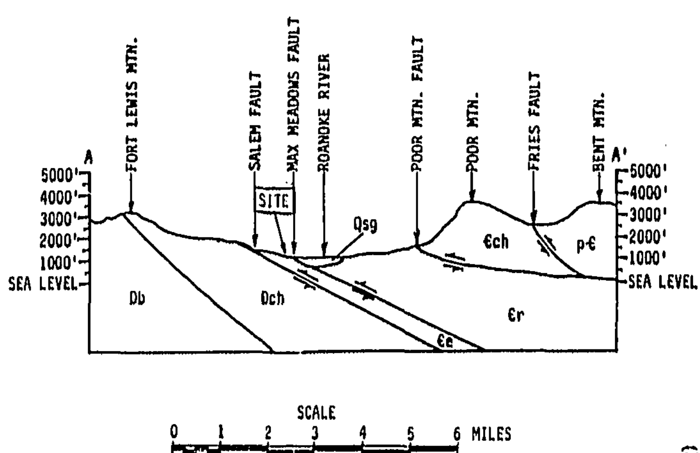
GEOLOGIC CROSS-SECTION FOR TRANSECT A--A'

EXPLANATION: SEE FIGURE 1



SOURCE: VIRGINIA STATE WATER CONTROL BOARD: WEST-CENTRAL REGIONAL OFFICE,
ROANOKE COUNTY GROUNDWATER--PRESENT CONDITIONS AND PROSPECTS.
BY N.K. BREEDING, JR. AND J.W. DAWSON JULY, 1976

FIGURE 4

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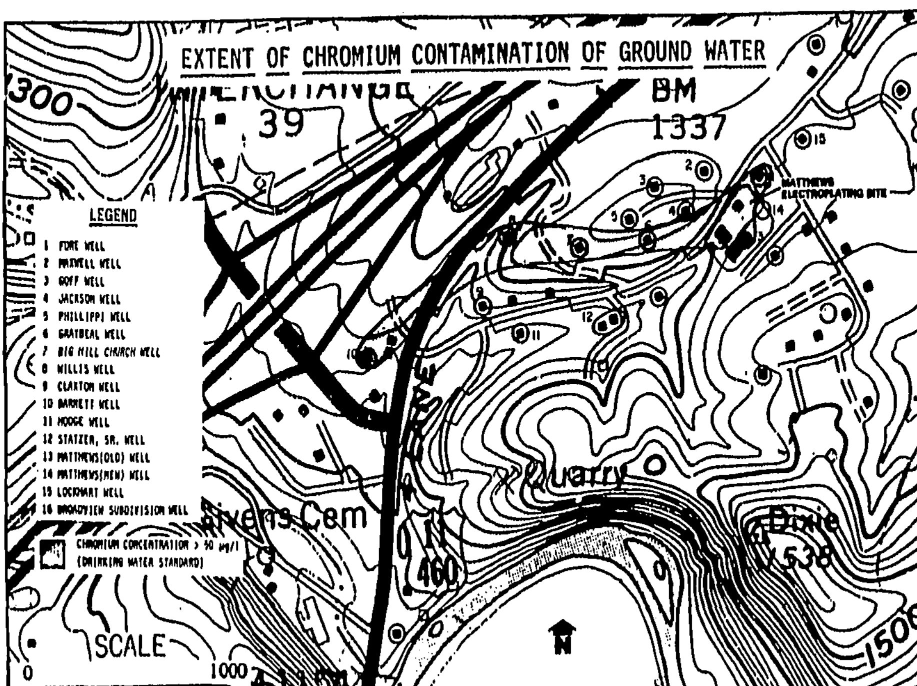

SOURCE: VIRGINIA STATE WATER CONTROL BOARD GROUND WATER MONITORING PROGRAM (1975 - 1979).

FIGURE 5

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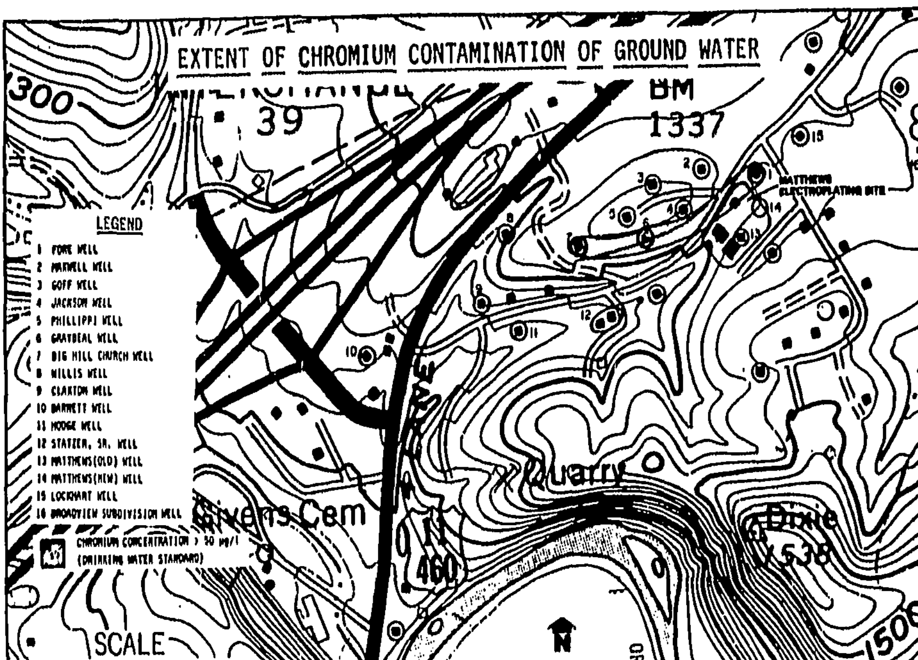

FIGURE 6

SOURCE: VIRGINIA STATE WATER CONTROL BOARD AND ROY F. WESTON, INC. GROUND WATER MONITORING PROGRAMS (1980 - 1984).

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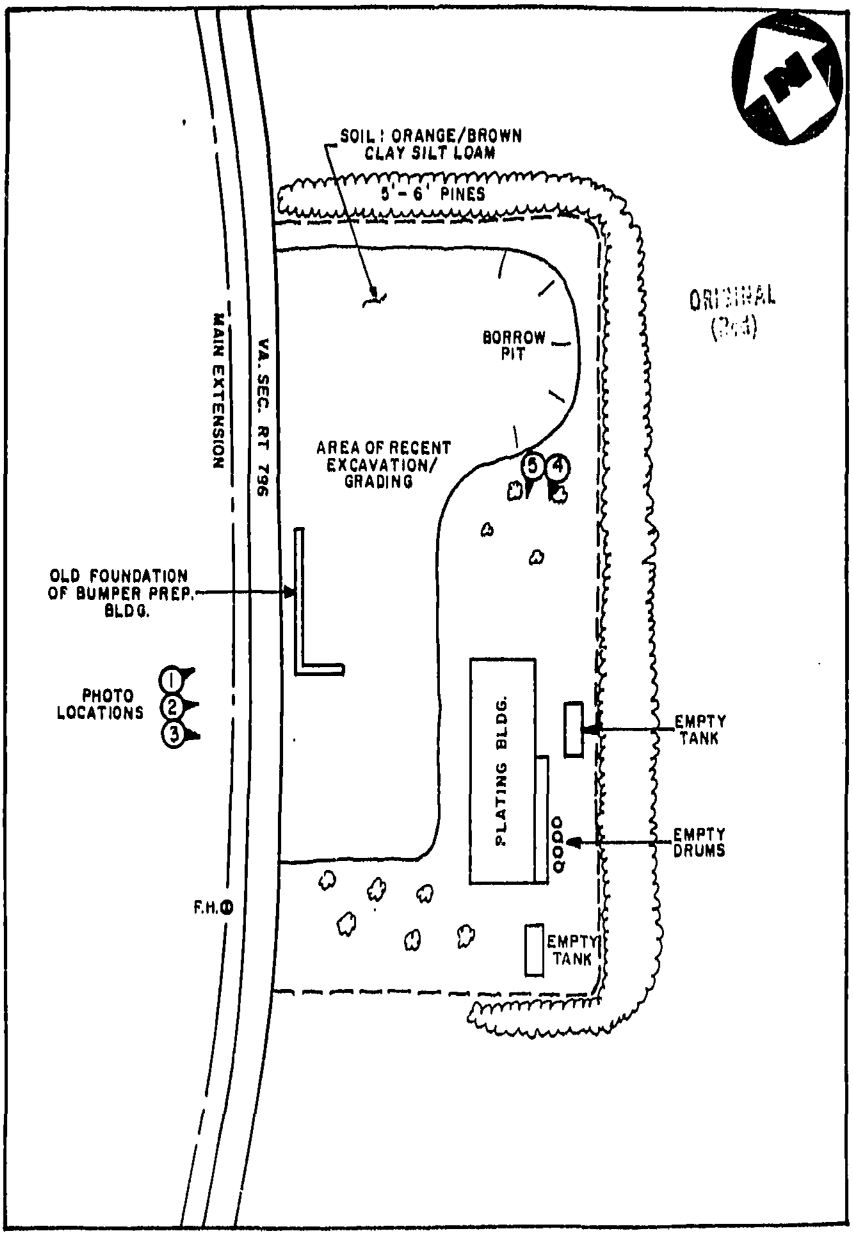

FIGURE 7

SITE SKETCH, APRIL, 1986
MATTHEWS ELECTROPLATING, SALEM, VA.
(NO SCALE)

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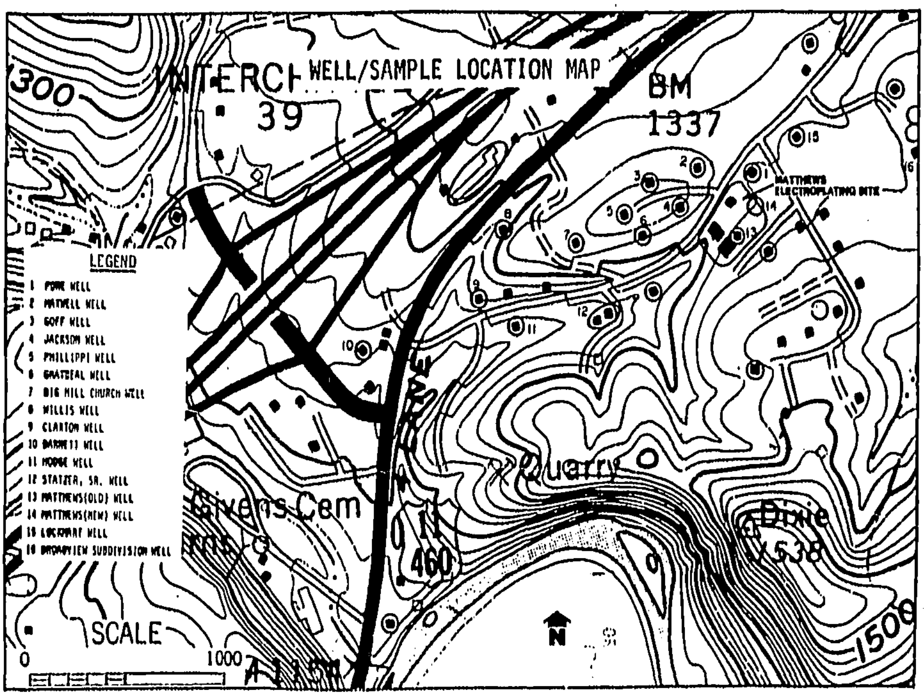

FIGURE 8

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APPENDIX C

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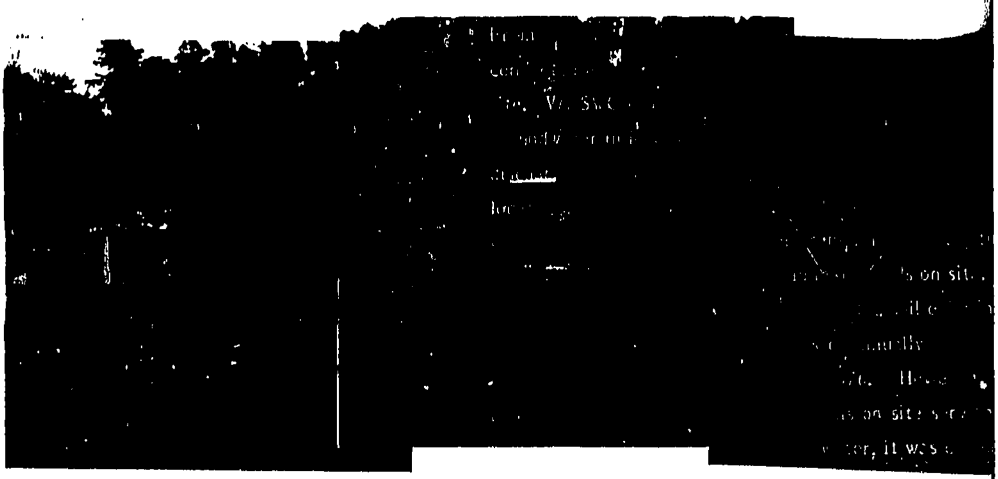

Photo 1, 2 and 3 - Panoramic view of site looking southeast.

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MATHEWS ELECTROPLATING
RIP TDD NO. F3-8602-45
VA 76 NP
PHOTO NO

PANORAMIC VIEW OF SITE
LOOKING SOUTHEAST

4/15/86
Robert L. Werner
ROBERT L WERNER

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RIP
Photo MATHEWS ELECTROPLATING
TDD NO. F3 8602 45
VA 76 NP
RIP
PHOTO NO

PANORAMIC VIEW OF SITE
LOOKING SOUTHEAST

4/15/86
Robert L. Werner
ROBERT L WERNER

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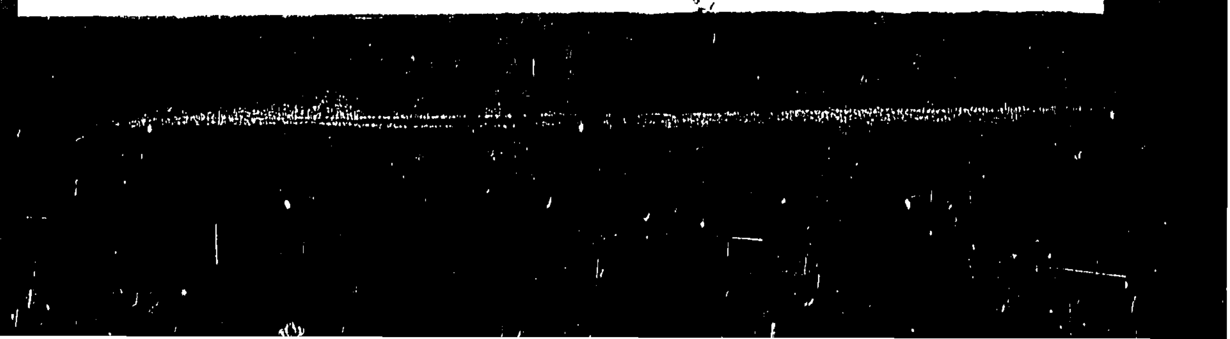

Photo 4 and 5 -
Panoramic view of rear of remaining
building looking southwest
(old plating building)

ORIGINAL
(Red)

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MATTHEWS ELECTROPLATING
TDD No. F3-8606-45
VA 76 NP

PANORAMIC VIEW OF REAR OF
REMAINING BUILDING LOOKING
(OLD PLATING BUILDING)

4/15/86
Robert J. Werner
ROBERT L. WERNER

MATTHEWS ELECTROPLATING
TDD No. F3-8606-45
VA 76 NP

PANORAMIC VIEW OF REAR OF
REMAINING BUILDING LOOKING SOUTHWEST
(OLD PLATING BUILDING)

4/15/86
Robert J. Werner
ROBERT L. WERNER

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APPENDIX D

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Table 3-1
(continued)

	Willis	Barnett	Blue Jay Motel	Blair Caverns	Angell	Anahlen	Wirt	Gallmore	Hall	Funchum	Turner	Dunn	G.H. Willis	Long
Aluminum	<50	<50	<50	<50	100	<50	<50	<50	<50	<200	<200	<200	<200	<200
Antimony	<10	<10	<10	<20	<10	<10	<20	<20	<10	<10	<10	<10	<10	<20
Arsenic	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Barium	20	40.	30.	80.	20.	30.	60.	20.	10.	500	230	430	350	<100
Beryllium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<5	<5	<5	<5	<5
Boron	30.	40.	<10	80.	<10	<10	<10	10.	<10	<100	<100	<100	<100	<100
Cadmium	<5	<5	10.	<5	<5	<5	<5	<5	<5	--	--	--		--
Calcium	50,700.	60,400.	48,300.	84,500.	63,300.	47,200.	54,100.	36,400.	31,300	--	--	--	--	--
Chromium, Total	40.	20.	<10.	<10	<10	<10	<10	<10	<10	15	<10	<10	<10	<10
Chromium, Cr VI	44.	20.	<4.	<4	<4	<4	<4	<4	<4	<10	<10	<10	<10	<10
Cobalt	<10	<10	<10	<10	<10	<10	<10	<10	<10	<50	<50	<50	<50	<50
Copper	<10	<10	<10	<20	<10	<20	<10	<10	20.	.23	<50	<50	<50	58
Cyanide	<10	<10	<10	<10	<10	<10	<10	<10	<10	*	--	--	--	--
Iron	<10	<10.	<10	<40.	100.	440.	440.	<10	40.	<170	<200	190	310	910
Lead	<40	<40	380.	<40	<40	<40	<40	<20	<40	.57	<5	<5	<5	33
Magnesium	20,600.	23,800.	20,000.	24,700.	31,000.	19,500.	23,500.	15,900.	12,900.	--	--	--	--	--
Manganese	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	30
Mercury	<1	<1	<1	<1	<1	<1	<1	<1	<1	<.2	<.2	<.2	<.2	<.2
Nickel	<20	<10	<10	<20	<10	<20	<20	<20	<20	<40	<40	<40	<40	<40
pH	7.4	7.2	7.6	7.3	6.9	7.5	7.1	7.6	7.5	--	--	--	--	--
Selenium	<10	<10	<10	<10	<10	<10	<10	<10	<10	<2	<2	<2	<2	<2
Silver	<10	<20	<10	<20	<10	<10	<20	<10	<20	<10	<10	<10	<10	<10
Sodium	4,500.	15,600.	17,500.	23,900.	3,000.	2,400.	3,800.	1,700.	800.	--	--	--	--	--
Thallium	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tin	<20	<20	<20	<10	<10	<30	<20	<20	<20	<10	<10	<20	<20	<10
Vanadium	<10	<10	<10	<10	<10	<10	<10	<10	<10	200	200	200	200	200
Zinc	810.	320.	90	<10	140.	390.	<10	550.	350.	57	340	37	18	85

Table 3-1 Recent Ground Water Sampling Data
(Concentrations in µg/L)

	Matthews Electroplating New Well	Ford	Lockhart	Maxwell	Gulf	Phillippi	Graybeal	Jackson	Big Hill Church	Wilson	Stalzer, Sr	Stalzer, Jr	Hodge	Clawson
Aluminum	<200	<50	100.	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	550.
Antimony	<20	<20	<20	<20	<10	<20	<20	<20	<20	<20	<20	<20	<20	<20
Arsenic	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Barium	<100	<10	<10	<10.	20.	<10	10.	30.	30.	<20.	<20.	10.	<10.	<30.
Beryllium	<5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	<100	210.	60.	<10	30.	20.	120.	30.	100.	60.	100.	<10	<10	<10
Cadmium	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	20.
Calcium	-	81,500.	67,700.	43,800.	55,800.	48,500.	66,500.	61,600.	54,600.	85,900.	86,300.	73,000.	88,800.	85,800
Chromium, Total	<1	100.	30.	<10	<10	<10	180.	20.	110.	<10	30.	<10	<10	<10
Chromium, Cr VI	<10	104.	12.	4.	13.	8.	191.	24.	120.	<4	16.	<4	4.	<4
Cobalt	<50	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Copper	<51	<10	<20	<10	10.	<20	<20	<10	<10	<10	<20	40.	<10	180.
Cyanide	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Iron	230	<20	100.	10.	<20	20.	<20	<20	140.	60.	<20	<20	<20	13,500.
Lead	<3	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	80.
Magnesium	-	33,300.	26,400.	17,600.	23,500.	18,900.	26,400	23,700.	34,300.	37,100.	36,600.	36,200.	39,300	33,700.
Manganese	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	160.
Mercury	<.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	<40	<20	<20	<20	<20	<10	<20	<20	<20	<20	<20	<20	<10	<20
pH	-	6.9	7.1	7.5	7.5	7.1	11.2	7.4	8.2	7.0	6.9	7.4	7.1	7.0
Selenium	<2	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Silver	<10	<20	<20	<20	<20	<10	<20	<20	<10.	<10	<20	<20	<20	<20
Sodium	-	15,600.	11,300.	3,800.	6,300	4,100.	7,500.	7,300	7,900	21,600.	11,600	3,400.	3,001.	1,700.
Thallium	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tin	<20	<10	<20	<20	<20	<20	<20	<20	<10	<10	<20	<10	<10	<20
Vanadium	<100	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Zinc	57	470.	1,440.	130.	<10	80.	400.	<10	230.	890.	180.	<10	20.	2,160.

Results of SWCB Ground Water Sampling [1,2,3]
(Concentrations in µg/L)

SAMPLING DATE	ANAHEIM	BARNETT	BIG HILL CHURCH	BLUE JAY MOTEL	BROADVIEW SUBDIVISION	CLANTON	CROSIER	DIXIE CAVERNS	DOW/BURKS	FORT/FITZGERALD/SMITH	GOFF	GRAYBEAL	HA
11/18-19/75			110†	<10†		<10†				<10†	<10†		
12/5/75													
12/17/75			110†										
2/9/76				<10†								11,500	
3/12/76						<10†						1,800†	
3/23/76													
8/5/76			20†	<10†		<10†				<10†			
8/12/76												1,450†	
11/12/76												1,550†	
12/10/76												1,460†	
1/18/77				<10†		10				30†			
3/10/77			20			10				40†	<10†	1,200†	
3/16/77												900	
5/5/77												1,050	
6/9/77												1,110	
4/20/78												180	
8/3/78				20,10						50,20		140	
11/1/78										110		690	
4/3/79													
6/1/79				<10						60		400,360*	
6/5/79												280*	
6/6/79				<10	<10*,10						<10*,10		
6/18/79				<10	<10*,20			<10			20*		
6/19/79					<10			<10		20	<10		
6/20/79													<1
8/29/79												210,260*	
9/6/79			190										
9/20/79		60			<10*					40	<10	120	
11/16/79										<10	<10		
11/20-21/79		60			<10*					<10	<10		
2/12/80	<10												
3/20/80								<10*		75	<10		
3/25/80		40*										150*	
4/1/80		26	93		<10*					50	<10	165	
11/10/80								<10*		40	10*	180*	
5/20/81		<10						<10		<10		210	
8/6/81		<10							<10	40,35			
1/27/82			95,80		<10		<10		<10	68,50	<10	210,299	

Results of SWCB Ground Water Sampling
(continued)

SAMPLING DATE	HODGE	JACKSON	LOCKHART	MATHEWS OLD WELL	MATHEWS NEW WELL	MAXWELL	PHILLIPPI	STATZER, SR.	STATZER, JR.	TURNER	VIEWPOINT HEIGHTS/ ANGELL/ TRUMBULL/ WIMMER	V.I. WILLIS	WILSON
11/18-19/75				18,600	10T		<10T	<10T			<10T	550T	<10T
12/5/75	<10T												
12/17/75													
2/9/76													
2/12/76					<10T		<10T	<10T				600T	
3/22/76			<10T					<10					<10T
8/5/76					10T		30T				<10T	1070T	<10T
8/12/76													
10/12/76													
12/10/76					<10T		<10T					850T	
1/18/77												810T	<10T
3/10/77					20T		20T						<10T
3/14/77													
5/5/77													
6/9/77												210	
4/10/78													
8/3/78								<10,20					
11/1/78	20							30			<10T	410	10
4/3/79	<10T							<10					<10
6/1/79	10*						10*	20*			10*	110	10*
6/5/79													
6/6/79											<10		
6/18/79	<10T	25*,10				15*					<10		
6/19/79						<10	<10	10*			<10	300,350T	<10
6/20/79			<10						<10				
8/29/79													
9/6/79													
9/20/79	<10T	10*				<10*	<10*	10*			<10*	210	<10
11/16/79	10							10	<10				<10
12/20-21/79	10	30*				30*	<10*	20			<10*		<10*
2/12/80			20*			<10*							
3/20/80	<10*	10*	<10*			<10*	<10*				<10*		<10*
3/25/80												210	
4/1/80	<10	11	<10			22	<10	<10			<10	150	<10
11/10/80	<10	30*				40*	20*	30*				170	<10
5/20/81	<10	<10				<10		40	<10		<10	65	
8/6/81										<10		10	
3/22/82	<10	<10,20	24,10			<10	<10	10,10	<10	<10	<10	18,15	<10

ORIGINAL (Red)